

Claims

1. A method for distributing and caching metadata related to files maintained in a file system, comprising the steps of:

5 exchanging any of files, objects, and file-, object-related information between a file server and a client via an intermediary device; and

 using any of file handles and IDs to convey said metadata for use by said intermediary device and said client.

10 2. The method of Claim 1, further comprising the step of:

 using said metadata in said file handles for any of eliminating a need for said intermediary device to generate additional requests to said server to establish file identity, and for completing client requests.

15 3. The method of Claim 1, further comprising the step of:

 using said intermediary device to encode metadata in the form of a session key into said file handle that expires after a predetermined amount of time.

4. The method of Claim 1, wherein said file system is an NFS file system.

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5. The method of Claim 1, wherein said file system uses a stateless protocol.

6. In a file system using a stateless protocol, a method for distributing metadata with client file handles using a proxy or software program, comprising the steps of:

25 inserting metadata into a file handle for use by a proxy and a client; and

using a file handle sent to clients by said proxy to store metadata at said client that is relevant to said file handle and operations that can be executed with said file handle;

wherein when a client that has said file handle requests an operation with said
5 file handle, said metadata are immediately available to said proxy from said client file handle.

7. The method of Claim 6, wherein said operations comprise any:

a WRITE operation to WRITE a block of data to a file server;
10 a LOOKUP operation to LOOKUP a file in said file server; and
a READ operation to READ a file in said file server.

8. The method of Claim 6, said inserting step comprising the step of:

using a cryptographic key for any of transforming and signing data in a
15 request, a reply, or the file handle.

9. The method of Claim 6, said inserting step comprising the step of:

said metadata determining for which data location server a request is
ultimately intended.
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10. In a file system, a method for using metadata associated with file handles, comprising the steps of:

inserting metadata into a file handle for use by a proxy and a client;
said proxy receiving a request from a client having a file handle containing
25 said metadata, wherein said metadata is intelligible to said proxy; and
sending a file handle to a file server without said metadata;

wherein said metadata allows said proxy to execute said client request appropriately.

11. The method of Claim 10, said inserting step comprising the step of:

5 using a cryptographic operation for any of transforming or signing data in a request, a reply or the file handle.

12. The method of Claim 10, said inserting step comprising the step of:

10 said metadata determining for which file server a request is ultimately intended.

13. An apparatus for distributing and caching metadata related to files maintained in a file system, comprising:

15 a file server;
 a proxy;
 a client;
 means for exchanging files and file related information between said file server and said client via a proxy; and
 means for inserting said metadata into file handles for use by said proxy and
20 said client.

14. The apparatus of Claim 13, further comprising:

 means for using said metadata in said file handles for any of eliminating a need for said proxy to generate additional requests to said server to establish file
25 identity, and appropriately completing a client request.

15. The apparatus of Claim 13, further comprising:

a session key for encoding said metadata into said file handle, wherein said session key expires after any of a predetermined amount of time and the occurrence of at least one predetermined condition.

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16. The apparatus of Claim 13, wherein said file system is an NFS file system.

17. The apparatus of Claim 13, wherein said file system uses a stateless protocol.

10 18. In a file system using a stateless protocol, an apparatus for distributing metadata with client file handles using a proxy or software program, comprising:

means for inserting metadata into a file handle for use by said proxy and said client; and

15 means for using a file handle sent to clients by a proxy to store metadata at said client that is relevant to said file handle and operations that can be executed with said file handle;

wherein when a client that has said file handle requests an operation with said file handle, said metadata are immediately available to said proxy from said client file handle.

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19. The apparatus of Claim 18, wherein said operations comprise any of:

a WRITE operation to WRITE a block of data to a file server;

a LOOKUP operation to LOOKUP a file in said file server; and

a READ operation to READ a file in said file server.

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20. The apparatus of Claim 18, said means for inserting comprising:

a cryptographic operation for any of transforming and signing data in a request, a reply, or the file handle.

21. The apparatus of Claim 18, said means for inserting comprising:

5 means for said metadata determining a file server for which a request is ultimately intended.

22. In a file system, an apparatus for using metadata associated with file handles, comprising:

10 means for inserting metadata into a file handle for use by a proxy and a client;
means for said proxy receiving a request from a client having a file handle containing said metadata, wherein said metadata are intelligible to said proxy; and
means for sending a file handle to a file server without said metadata;
wherein said metadata allow said proxy to execute said client request
15 appropriately.

23. The apparatus of Claim 22, said means for inserting comprising:

a cryptographic operation for transforming data in a request or reply.

20 24. The apparatus of Claim 22, said means for inserting comprising:

means for said metadata determining a file server for which a request is ultimately intended.

25. A method for accessing a storage object with a client, comprising the steps of:

25 said client initially interacting with a server;
said client obtaining a storage object identifier;

said client using said storage object identifier in connection with storage object transactions;

said client associating metadata with said storage object identifier; and

said client using said storage object identifier to convey said metadata.

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26. In a file system, a method for distributing metadata with client file handles using a proxy or software program, comprising the steps of:

inserting metadata into a file handle for use by a proxy and a client; and

using a file handle sent to clients by said proxy to store metadata at said client

10 that is relevant to said file handle and operations that can be executed with said file handle;

wherein when a client that has said file handle requests an operation with said file handle, said metadata are immediately available to said proxy from said client file handle.

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27. The method of Claim 26, wherein said operations comprise any:

a WRITE operation to WRITE a block of data to a file server;

a LOOKUP operation to LOOKUP a file in said file server; and

a READ operation to READ a file in said file server.

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28. The method of Claim 26, said inserting step comprising the step of:

using a cryptographic key for any of transforming and signing data in a request, a reply, or the file handle.

25 29. The method of Claim 26, said inserting step comprising the step of:

said metadata determining for which data location server a request is ultimately intended.